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Patient and clinician factors associated with prehospital pain treatment and outcomes: cross sectional study

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ABSTRACT

Objective: We aimed to identify how patient (age, sex, condition) and paramedic factors (sex, role) affected prehospital analgesic administration and pain alleviation.

Methods: We used a cross-sectional design with a 7-day retrospective sample of adults aged 18 years or over requiring primary emergency transport to hospital, excluding patients with Glasgow Coma Scale below 13, in two UK ambulance services. Multivariate multilevel regression using Stata 14 analysed factors independently associated with analgesic administration and a clinically meaningful reduction in pain (≥ 2 points on 0–10 numerical verbal pain score [NVPS]).

Results: We included data on 9574 patients. At least two pain scores were recorded in 4773 (49.9%) patients. For all models fitted there was no significant relationship between analgesic administration or pain reduction and sex of the patient or ambulance staff.

Reduction in pain (NVPS ≥ 2) was associated with ambulance crews including at least one paramedic (odds ratio [OR] 1.52, 95% confidence interval [CI] 1.14 to 2.04, $p < 0.01$), with any recorded pain score and suspected cardiac pain (OR 2.2, 95% CI 1.02 to 4.75).

Intravenous morphine administration was also more likely where crews included a paramedic (OR 2.82, 95% CI 1.93 to 4.13, $P < 0.01$), attending patients aged 51 to 64 years (OR 2.04, 95% CI 1.21 to 3.45, $p = 0.01$), in moderate to severe (NVPS 4–10) compared with lower levels of pain for any clinical condition group compared with the reference condition.

Conclusion: There was no association between patient sex or ambulance staff sex or grade and analgesic administration or pain reduction.

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1. Introduction

Acute pain has been defined as that which results 'from an acute injury or disease process and persists only as long as the tissue pathology itself' [1]. Acute or acute-on-chronic pain is a common reason for calling an emergency ambulance, with four fifths of patients attended being in

pain, of which one fifth reported that ambulance staff could have done more to alleviate their pain [2].

Several factors have been found to affect the quality of pain management practice by ambulance staff. Different grades of ambulance staff differ in their training and capability to deliver analgesics: paramedics who are registered health professionals in the United Kingdom (UK) and elsewhere can administer drugs intravenously (e.g. morphine or paracetamol) or under Patient Group Directions, whereas non-registered staff, such as Emergency Medical Technicians (EMTs) or Emergency Care Assistants (ECAs), are only able to administer drugs such as Entonox [3]. Although decisions about pain relief are

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Table 1
Demographic characteristics of patients and ambulance staff.

	Number (N = 9574)	Percentage
Age/years		
18–30	1162	12.1%
31–50	1606	16.8%
51–64	1518	15.9%
65–74	1409	14.7%
75–84	1956	20.4%
85+	1911	20.0%
Missing	12	0.1%
Patient sex		
Female	4911	51.3%
Male	4524	47.3%
Missing	139	1.5%
Patient ethnicity		
White	1701	17.8%
Asian	888	9.3%
Black	30	0.3%
Mixed	14	0.1%
Unable to record	921	9.6%
Missing	6020	62.9%
Ambulance staff sex		
Female	3303	34.5%
Male	5303	55.3%
Missing	968	10.1%
Ambulance staff grade		
Non-paramedic only	2762	28.8%
Paramedic only	2825	29.5%
Mixed crews	3549	37.1%
Missing	438	4.6%

determined by national guidance for ambulance services and their staff [4], such decisions are complicated in the prehospital setting because of differences in patients' beliefs and needs [5], and variations in ambulance staff access to care options, resources and training, tolerance of risk or performance priorities [6].

Factors associated with receiving prehospital analgesia for fracture or suspected acute myocardial infarction include the initial assessment of pain severity, its causation, and level of patient alertness [7]. One study from the United States (US) showed that males were significantly more likely to receive analgesia for isolated extremity fractures after controlling for confounding variables [8]. Another study from Australia found no significant association between patient sex and provision of any prehospital analgesia but did find differences when comparing type of analgesia, with males significantly more likely to receive opiates than females after controlling for age, pain aetiology and severity [9]. Despite the odds of analgesia administration being unaffected by sex of paramedic, both male and female paramedics were significantly more likely to administer opiates to male patients [10].

Disparities in management of acute pain have also been found, in Emergency Department settings, to be associated with clinician and

patient sex, pain severity, clinical condition, patient age, educational status and ethnicity [11–15].

Ambulance clinicians have an important role in managing acute pain experienced by individuals who call on them. The 'Declaration of Montreal' went further, stating that access to relief from acute pain was a fundamental human right [16]. Further to the ethical imperative to relieve pain, the early and effective alleviation of acute pain may also reduce the risk of pain-related morbidities, including the development of chronic pain syndromes [1,17]. Although previous research has investigated various aspects of ambulance clinicians' pain management practice, significant gaps in knowledge remain.

This study therefore aimed to investigate patient and practitioner factors affecting prehospital pain management practice and outcomes, including administration of analgesics by ambulance clinicians (paramedics, EMTs or ECAs), and reduction in pain in adult patients attended by ambulance clinicians. The objective was to explore whether practitioner-initiated analgesia or reduction in pain differed according to factors such as an adult patient's age, sex, ethnicity or causation of pain, and clinician factors such as sex or professional status.

2. Methods

2.1. Study design and setting

We conducted a cross-sectional analysis using retrospectively collected clinical data from two regional English ambulance services.

One ambulance service comprised around 1500 ambulance clinicians (paramedics, EMTs and ECAs) serving a population of over 4 million people, in four predominantly rural counties with some densely populated urban areas. The other service employing around 2100 paramedics, EMTs and ECAs covered 4.8 million people in six predominantly rural counties, but also having some densely populated cities.

2.2. Participants

We included records for all adult patients aged 18 years and over where an emergency ambulance was called resulting in transportation to hospital during one week, from 11 to 18 April 2016. Clinical data were obtained by ambulance staff from electronic records in one service and from electronic records or paper records, scanned and verified by a trained data clerk, in the other.

Patient inclusion criteria were all cases involving primary transport to hospital in the consecutive 7-day period; patient age equal to or >18 years; in the participating ambulance services. Exclusion criteria were: secondary transports including inter-hospital transfers, or; patients with a Glasgow Coma Scale (GCS) score below 13, where scores below 15 indicate a reduced level of consciousness and a score <13 moderate (GCS 9–12) or severely (GCS <9) impaired consciousness.

Table 2
Analgesic use according to initial pain score.

Initial pain score	Analgesic								
	Ibuprofen	Paracetamol	Co-codamol	Codeine	Entonox	Paracetamol IV	Tramadol	Morphine oral	Morphine IV
0	17 (12.3%)	277 (22.0%)	1 (7.7%)	3 (2.9%)	90 (11.2%)	10 (7.0%)	1 (5.9%)	20 (25.0%)	70 (10.4%)
1–3	6 (4.3%)	65 (5.2%)	1 (7.7%)	4 (3.8%)	17 (2.1%)	2 (1.4%)	1 (5.9%)	4 (5.0%)	17 (2.5%)
4–6	20 (14.5%)	171 (13.6%)	3 (23.1%)	19 (18.1%)	83 (10.4%)	9 (6.3%)	2 (11.8%)	6 (7.5%)	79 (11.8%)
7–10	56 (40.6%)	338 (26.8%)	6 (46.2%)	46 (43.8%)	400 (49.9%)	73 (51.0%)	6 (35.3%)	32 (40.0%)	349 (52.0%)
Missing	39 (28.3%)	409 (32.5%)	2 (15.4%)	33 (31.4%)	211 (26.3%)	49 (34.3%)	7 (41.2%)	18 (22.5%)	156 (23.2%)
Total	138	1260	13	105	801	143	17	80	671

Table 3

Reduction in pain score when two pain scores recorded and both not zero.

Pain reduction	Number N = 2419	Percentage
–7	2	0.08
–5	3	0.12
–4	2	0.08
–3	17	0.7
–2	10	0.41
–1	32	1.3
0	1253	51.8
1	213	8.8
2	263	10.9
3	183	7.6
4	150	6.2
5	122	5.0
6	65	2.7
7	36	1.5
8	37	1.5
9	14	0.6
10	17	0.7

*Negative values indicate increase in pain from baseline value.

2.3. Data collected

Patient data comprised demographic variables including age, sex, and ethnicity; and clinical findings recorded by the paramedic including clinical condition, level of consciousness using GCS and AVPU (alert, verbal response, response to pain and unconscious), initial and final numerical verbal pain scores (NVPS recorded using an 11-point, 0 to 10 scale) and analgesic use.

Ambulance clinician variables including sex and professional status (i.e. paramedic vs. non-registered staff such as EMT or ECA) were identified from organisational records. We also accessed the time of arrival of the ambulance clinician at the scene of the emergency (usually the patient's home) and the time of handover at hospital.

2.4. Outcomes of interest

The outcome (dependent) variables used were administration of analgesia by the ambulance clinician and a clinically meaningful reduction in pain of 2 points or more on the NVPS [18,19].

2.5. Data analysis

The anonymised data sets from both services were combined in Stata 14 for statistical analysis. We used descriptive statistics to summarise patient and clinician variables. As we were interested in the outcomes of ambulance clinicians treating patients of the same or opposite sex, we classified crews as either all female, all male or mixed sex. A multivariate multivariable (two-level) regression model was used to determine factors independently associated with use of analgesia and reduction of 2 points or more on the NVPS.

3. Results

3.1. Characteristics of subjects

In all, 9574 records, of adult patients transported to hospital, were available for analysis (3344 from one service and 6230 from the other) once inclusion and exclusion criteria were applied.

Summary statistics for demographic characteristics of patient and ambulance staff are shown in Table 1. Patient complaints (see Table A1) were categorised as follows: mental health/drug overdose (708/9574: 7.4%), cardiac (1959/20.5%), trauma/fall/fracture (1414/14.8%); musculoskeletal/headache (506/ 5.3%), stroke/neurological/collapse (1114, 11.6%), other medical/surgical including abdominal/urinary/sepsis/

allergy/unwell (2142; 22.4% (all other complaints (1681, 17.6%) and missing (50; 0.5%).

Analgesic use was classified as paracetamol only (899/9574: 9.4%), non-steroidal anti-inflammatory drugs (NSAIDs: ibuprofen or naproxen only; 37; 0.4%), co-codamol, codeine dihydrocodeine, tramadol or oral morphine only (201; 2.1%), Entonox nitrous oxide and oxygen 1:1) only (372; 3.9%), paracetamol IV only (58; 0.6%), morphine IV only (355, 3.7%), combinations of the above (762; 7.9%) or no analgesia administered (6890; 72.9%).

Analgesic use according to initial pain score is shown in Table 2 and change in pain score is shown in Table 3. There was a high rate of

Table 4

Multivariate logistic regression showing factors associated with reduction in pain score of two points or more.

	Odds ratio	95% CI	P-value
Patient complaint category			
Mental health/drug overdose	Reference		
Cardiac	2.2	(1.02 to 4.75)	0.04
Trauma/fall/fracture	1.56	(0.71 to 3.43)	0.27
Musculoskeletal/headache	2.17	(0.96 to 4.93)	0.06
Other medical	1.97	(0.93 to 4.19)	0.08
(abdominal/urinary/sepsis/allergy/unwell)			
Stroke/neurological/collapse	1.75	(0.72 to 4.24)	0.22
Patient sex			
Female	Reference		
Male	1.06	(0.82 to 1.38)	0.65
Patient age/years			
18–30	Reference		
31–50	0.94	(0.61 to 1.47)	0.79
51–64	1.23	(0.78 to 1.92)	0.37
65–74	1.38	(0.86 to 2.2)	0.18
75–84	1.22	(0.77 to 1.92)	0.4
85+	1.27	(0.77 to 2.09)	0.34
Initial pain score			
0	Reference		
1–3	0.1	(0.05 to 0.18)	P < 0.01
4–6	0.44	(0.32 to 0.59)	P < 0.01
7–10	(omitted)		
Glasgow coma scale			
13	Reference		
14	1.06	(0.27 to 4.16)	0.94
15	1.35	(0.41 to 4.47)	0.63
Paramedic sex			
Female	Reference		
Male	0.89	(0.67 to 1.17)	0.4
Paramedic grade			
No paramedic attending	Reference		
Paramedic attending	1.52	(1.14 to 2.04)	P < 0.01
Time between first and last pain score			
Under 5 min	2.88	(0.59 to 13.98)	0.19
>5 and ≤10 min	3.11	(0.66 to 14.67)	0.15
>10 and ≤15 min	3.84	(0.78 to 18.82)	0.1
>15 and ≤45 min	3.31	(0.72 to 15.33)	0.13

missing initial pain score in 42.4% (4063/9574), and this was the case even where analgesics were administered suggesting that pain was likely to have been present (Table 2). For example, an initial pain score was not recorded in 23.2% of patients when intravenous morphine was administered. Analgesics, including morphine, were also used even where an initial pain score was zero (Table 2). At least two pain scores were recorded in 49.9% (4773/9574) of the sample and after excluding those patients where both pain scores were zero (49.3%, 2419/4773), pain was reduced in 45.5% (1100/2419), increased in 2.7% (66/2419) and unchanged in 51.8% (1253/2419) of patients (Table 3).

3.2. Main results

We fitted multilevel regression models to show which factors independently predicted a reduction in two or more points on the NVPS (Table 4), use of intravenous morphine (Table 5), and use of oral paracetamol or a non-steroidal anti-inflammatory drug, i.e. ibuprofen or naproxen (Table 6).

A clinically meaningful reduction in pain (NVPS of 2 points or more) was associated with an ambulance crew which included at least one paramedic (odds ratio [OR] 1.52, 95% confidence interval [CI] 1.14 to 2.04, $p < 0.01$) and was more likely when attending patients with any recorded pain score (compared with no pain) or with suspected cardiac pain (OR 2.2, 95% CI 1.02 to 4.75, $p = 0.04$) (Table 4).

Reduction in pain (NVPS ≥ 2) was associated with ambulance crews including at least one paramedic (odds ratio [OR] 1.52, 95% confidence interval [CI] 1.14 to 2.04, $p < 0.01$), with any recorded pain score and having suspected cardiac pain (OR 2.2, 95% CI 1.02 to 4.75).

Use of intravenous morphine was also more likely when the following features were present: the ambulance crew had at least one paramedic compared to those with only EMTs or ECAs (OR 2.82, 95% CI 1.93 to 4.13, $P < 0.01$); patients were in the age group 51 to 64 years (OR 2.04, 95% CI 1.21 to 3.45, $p = 0.01$) compared with other patient ages; patient were in moderate to severe pain (NVPS 4–10) compared with mild or no (NVPS 0–3) pain; and patients were affected by certain groups of clinical conditions, e.g. cardiac, trauma, musculoskeletal pain or headache and other medical conditions compared with mental health conditions assumed to have no pain (Table 5).

Use of paracetamol or a non-steroidal anti-inflammatory drug (NSAID) such as ibuprofen, was not associated with clinician grade, but was associated with any pain score above zero and with all condition groups, compared with the reference category of mental health conditions (Table 6).

For all the models fitted there was no significant relationship between analgesic use or pain reduction and patient sex or sex or grade of ambulance staff member. Ethnicity was insufficiently well recorded to be included in the models.

4. Discussion

This study included case records from a seven-day period in two large regional ambulance services which contrasted with previous studies which involved single organisations in Australia [9] and the US [13].

We found no relationship between reduction in pain or analgesic use and sex of patients or ambulance staff. Use of intravenous morphine varied according to patient age, cause of pain, and whether a paramedic was in attendance. Reduction in pain score was more likely for patients with higher initial pain scores and where a paramedic was in attendance.

As might be expected, because of their licence to administer morphine intravenously, this drug was only able to be used when a paramedic was in attendance. Paracetamol or non-steroidal drugs were not associated with a paramedic being in attendance, reflecting the fact that other staff such as EMTs or ECAs were able to administer these drugs.

Use of analgesics even where an initial pain score was zero may have been due to pain being absent at rest but related to movement of an injured area or worsening of a medical condition. Morphine may also have been used to relieve symptoms such as breathlessness due to acute left ventricular failure or carcinoma, and in some cases of distress rather than pain. Previous qualitative studies suggest that patients may not recognise that an ache or discomfort constituted “pain” and may therefore report a pain score of zero, even in serious conditions such as acute coronary syndrome [5].

Poor recording of initial and repeat pain scores, despite pain being present, was evident in this as in previous studies [7,20]. Pain scoring is important for assessing pain severity and is an important predictor

Table 5

Multivariate logistic regression showing factors associated with use of parenteral morphine.

	Odds ratio	95% CI	P-value
Patient complaint category			
Mental health/drug overdose	Reference		
Cardiac	6.87	(1.62 to 29.19)	0.01
Trauma/fall/fracture	21.38	(5.1 to 89.66)	$P < 0.01$
Musculoskeletal/headache	15.59	(3.59 to 67.66)	$P < 0.01$
Other medical (abdominal/urinary/sepsis/allergy/unwell)	17.07	(4.12 to 70.81)	$P < 0.01$
Stroke/neurological/collapse	(omitted)		
Patient sex			
Female	Reference		
Male	1.03	(0.77 to 1.39)	0.83
Patient age/years			
18–30	Reference		
31–50	1.67	(1 to 2.78)	0.05
51–64	2.04	(1.21 to 3.45)	0.01
65–74	1.52	(0.87 to 2.67)	0.14
75–84	1.02	(0.59 to 1.78)	0.93
85+	0.78	(0.42 to 1.42)	0.41
Initial pain score			
0	Reference		
1–3	1.31	(0.62 to 2.77)	0.48
4–6	3.71	(2.26 to 6.09)	$P < 0.01$
7–10	7.98	(5.32 to 11.98)	$P < 0.01$
Glasgow coma scale			
13	Reference		
14	1.14	(0.24 to 5.37)	0.87
15	1.21	(0.31 to 4.74)	0.78
Paramedic sex			
Female	Reference		
Male	0.87	(0.64 to 1.18)	0.36
Paramedic grade			
No paramedic attending	Reference		
Paramedic attending	2.82	(1.93 to 4.13)	$P < 0.01$
Time between first and last pain score			
Under 5 min	0.2	(0.06 to 0.66)	0.01
>5 and ≤ 10 min	0.33	(0.11 to 0.95)	0.04
>10 and ≤ 15 min	0.44	(0.14 to 1.37)	0.16
>15 and ≤ 45 min	0.57	(0.21 to 1.56)	0.27

Table 6

Multivariate logistic regression showing factors associated with use of paracetamol or NSAID only.

	Odds ratio	[95% Conf. interval]	P-value
Patient complain category			
Mental health/drug overdose	Reference		
Cardiac	8.2	(2.92 to 22.85)	P < 0.01
Trauma/fall/fracture	12.8	(4.57 to 35.76)	P < 0.01
Musculoskeletal/headache	13.9	(4.84 to 39.82)	P < 0.01
Other medical (abdominal/urinary/sepsis/allergy/unwell)	10.33	(3.73 to 28.58)	P < 0.01
Stroke/neurological/collapse	6.03	(2.06 to 17.65)	P < 0.01
Patient sex			
Female	Reference		
Male	0.86	(0.69 to 1.07)	0.18
Patient age/years			
18–30	Reference		
31–50	1.07	(0.72 to 1.58)	0.74
51–64	1.11	(0.74 to 1.66)	0.61
65–74	0.73	(0.47 to 1.12)	0.15
75–84	0.85	(0.57 to 1.26)	0.42
85+	0.86	(0.57 to 1.3)	0.47
Initial pain score			
0	Reference		
1–3	1.9	(1.24 to 2.91)	P < 0.01
4–6	2.37	(1.71 to 3.29)	P < 0.01
7–10	2.4	(1.83 to 3.15)	P < 0.01
Glasgow coma scale			
13	Reference		
14	1.24	(0.37 to 4.13)	0.73
15	1.75	(0.58 to 5.3)	0.32
Paramedic sex			
Female	Reference		
Male	1.03	(0.81 to 1.3)	0.83
Paramedic grade			
No paramedic attending	Reference		
Paramedic attending	1.27	(0.99 to 1.64)	0.06
Time between first and last pain score			
Under 5 min	2.69	(0.77 to 9.4)	0.12
>5 and ≤10 min	2.46	(0.72 to 8.41)	0.15
>10 and ≤15 min	2.29	(0.64 to 8.18)	0.2
>15 and ≤45 min	2.24	(0.66 to 7.52)	0.19

of effective treatment and relief of pain [7]. Lack of pain score recording may be due to patient or clinician barriers which can result in inadequate analgesia or use and recording of non-drug measures to relieve patients' pain, such as immobilisation with a splint, explanation or reassurance [5,21].

In a previous Australian study, use of analgesia was not associated with patient sex or age or with paramedic sex [10], but use of opiates was less likely in women compared to male patients [9,10]. An earlier study from New South Wales also showed lower use of morphine or fentanyl in women patients [22]. A study of analgesia in the Emergency Department also showed differences in opioid analgesia

according to male patient sex (OR = 0.58), male patient-physician interaction (OR = 2.58), arrival pain score (OR = 1.28), average pain score (OR = 1.10), and number of pain assessments (OR = 1.5); pain relief was not related to patient sex [11].

We did not find that use of intravenous morphine was associated with patient sex but this may have been because different patterns of analgesics are in use in Australia, where methoxyflurane, not widely used in the UK, is the most commonly administered agent. We did find that intravenous morphine was significantly more likely to be used in patients aged 51–64 years, those with moderate or high initial pain scores or patients where a paramedic was in attendance. This pattern of use may have reflected that morphine is administered by paramedic staff usually for conditions such as suspected cardiac chest pain or trauma causing moderate or severe pain. [7]

Shortfalls in prehospital pain assessment were evident in this study as in previous studies [7]. Effective pain assessment and analgesia in the ambulance are known to be associated with reduced pain on arrival at ED [23], earlier emergency pain relief [24] and improved perception of overall care quality [25]. Previous studies have suggested that effective prehospital pain management may be impeded by paramedic and patient attitudes such as reluctance to administer opioids for certain conditions or in the absence of clinical signs, uncertainty about the extent of pain reduction to aim for, concerns about potential malingering, and a fear of masking symptoms [5,21]. In contrast, ambulance clinicians and patients felt that pain management could be enhanced by improving pain assessment strategies, optimising non-drug strategies, widening analgesic options and enhancing communication and coordination in care pathways [5].

Ambulance services have increased the proportion of non-paramedic staff in their workforce, partly because of shortfalls in qualified paramedics. As the number of ambulance crews without a paramedic increases, access to and administration of drugs like morphine, which can effectively reduce pain, may be diminished. Services will need to consider whether or how to increase provision of effective analgesia, by either increasing the proportion of paramedic qualified staff, or by increasing the range of analgesics for moderate to severe pain available to non-paramedic staff.

4.1. Limitations

Our analysis was limited by the restricted period of data collection and by under-recording of pain scores in patients with pain. There were high levels of recording of patient sex and age but over a third of the data (34.2%) on sex of ambulance clinician was missing. Poor recording of ethnicity (62.9% missing) meant that we could not include this variable in our analysis. Failure to include vital signs in our statistical model for morphine administration was a limitation since paramedics will appropriately withhold morphine in patients who are hypotensive. We did not include illness acuity, which is another recognised source of variation in acute pain management [26].

5. Conclusion

We found no association between patient sex or sex or grade of ambulance staff member and analgesic use or pain reduction, but there remains an overriding need to improve prehospital pain management practice. This might be achieved through better pain assessment tools and practices, optimising non-drug treatment options for pain, widening use of analgesics including for EMTs and ECAs, better communication and coordination of pain management and through education, monitoring and feedback [5]. Further work needs to be done to identify and address disparities in pain management. Innovations in pain management needs to be underpinned by research to evaluate the effects and improvement programmes to translate effective strategies into day-to-day practice in this key area of prehospital care [27].

Table A1

Recorded chief complaint.

Chief complaint	Number	Percentage
	N = 9574	
Chest pain	869	9.1%
Fall	798	8.3%
Respiratory problems	765	8.0%
Abdominal pain	715	7.5%
Unwell	483	5.0%
Collapse	409	4.3%
Mental health problem	319	3.3%
Overdose	317	3.3%
Stroke or transient ischaemic attack	231	2.4%
Non cardiac chest pain	219	2.3%
Sepsis/septic shock	220	2.3%
Convulsions - non-febrile	212	2.2%
Chest infection	182	1.9%
Back pain	172	1.8%
Road traffic collision	176	1.8%
Haematuria	163	1.7%
Dizziness	143	1.5%
Cardiac problems	131	1.4%
Diarrhoea/vomiting	137	1.4%
Fracture (suspected)	133	1.4%
Head injury	120	1.3%
Rectal bleed	104	1.1%
Diabetic problems	95	1.0%
Headache	90	0.9%
Gastrointestinal bleed/haematemesis	77	0.8%
Intoxicated	72	0.8%
Wound	76	0.8%
Allergic reaction	59	0.6%
Fracture neck of femur (suspected)	60	0.6%
Assault	51	0.5%
Catheter problems	46	0.5%
Epistaxis	45	0.5%
Maternity	36	0.4%
Vaginal bleed	39	0.4%
Deep vein thrombosis	25	0.3%
Cardiac arrest	22	0.2%
Miscarriage	18	0.2%
Cardiac failure	12	0.1%
Meningitis (suspected)	2	0.0%
Missing	1731	18.1%

Grant

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Presentations

Pocock H et al. Oral presentation prize at the Berkshire Trauma Conference, Celebrating Trauma Research in the Thames Valley, 22 March 2017.

Asghar Z et al. Poster presentation to be given at 999 EMS Research Forum conference, 'The way forward for emergency care research: inclusion; collaboration; sustainability', 28–29 March 2017, Bristol, UK.

Williams J et al. Oral presentation to be given at the College of Paramedics National Conference, entitled "Learn, Develop, Achieve, Aspire" 9–10 May 2017, St Johns Hotel, Solihull, UK.

Conflicts of interest

None.

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